Schneider, Ph.D. (Columbia), has been called to the chair in Northwestern University vacant through the resignation of Professor Kraemer.

Dr. L. Schlesinger, of Bonn, has been appointed full professor of mathematics at Klausenburg; Dr. Detmer, associate professor of botany in the University of Jena, has been promoted to a full professorship; Dr. Lassar Cohn, professor of chemistry in the University at Königsberg, has been elected director of the Liebig Akademie of Munich; Dr. A. O. Kihlman has been appointed associate professor of botany at Helsingfors, and Dr. G. J. Ptaschicky, professor of zoology in St. Petersburg; Dr. F. v. Luschan, docent in the University of Berlin, has been promoted to a professorship of anthropology; Dr. Seelhorst, director of the Agricultural Experiment Station at Göttingen has accepted a professorship in the Agricultural College at Hohenheim.

DISCUSSION AND CORRESPONDENCE.

COLOR STANDARDS.

It is a matter for congratulation that the subject of color standards and definitions has been brought before the public for discussion in Science* Education in any branch of knowledge becomes simple and successful in proportion as its terminology is definite and intelligible. It would be quite interesting to set forth the plans that have been offered for obtaining color standards; one proposes to take an orange as the type of that color, and in like manner to let a lemon, an olive, etc., be the ultimate definition of those hues. One has even suggested a collection of wines of various colors as standards, and the matching of other colors by mixing the wines, an operation as dangerous as it is unscientific.

In the search for standards we must first be able to define completely a colored surface; not by saying that it resembles or differs to a certain extent from some other arbitrary surface, but it must be defined in terms of certain invariable and readily reproducible standards.

To describe completely a surface we must give value to four factors which go to affect the impression which it produces upon the normal observer: First, the predominating wave-length or wave-lengths of the light coming from it; second, its total luminosity, as compared with some standard; third, its saturation, or the ratio of the colored light to the total luminosity; fourth, its texture.

The matter of texture may be eliminated by placing the surface far enough from the eye, or, better, by rotating it so rapidly that the eye cannot distinguish the texture; consequently a standard of texture is unnecessary. A standard of total luminosity is easily obtained by holding a cold surface over burning magnesium or zinc; the coating of oxide thus produced has been adopted as 'white' by Rood, Mayer and others. In other words, the luminosity of such a surface is taken as 100 %. A box about five feet in length and one in cross-section, lined with black velvet and provided with an opening about four inches in diameter in one end, when so mounted that light cannot shine directly into the opening, will furnish an admirable standard black, or 0 % luminosity. Between these two extremes fall all surfaces not incandescent. White cardboard and lamp-black form very convenient 'practical units,' and their relation to the standards can at any time be easily and accurately determined. The question of saturation, or the ratio of the energy of the predominating characteristic wave-lengths to the total visible energy, is serious. In fact, for the present we must be satisfied to agree upon some temporary standards which may ultimately be absolutely determined.

As to the predominating or characteristic wave-length or wave-lengths we might, of course, refer everything to the spectrum and define by it directly, but it would be a very elaborate and inconvenient method. It is, however, customary to adopt a few typical wave-lengths and define by combinations of these. Theoretically three such colors are sufficient, but practical convenience makes it desirable to have five or six. Then a mixture of these, with the addition of black and white when necessary, enable the observer to match any color, shade, tint or hue.

What shall govern the choice of the five or six working standards? Of course, we expect red, green and blue; probably yellow, and pos-

* See article in Science, July 16, p. 89.

sibly orange and violet. At first the scientific method would seem to be to choose from the spectrum itself and locate those colors ideally, but we wish concrete surfaces of paper or similar material for our working standards, and if we choose our colors thus can we match them in practice? Chromolithography can do wonders and can nearly match a spectrum color. The objection, however, to such working standards is that each lithographer, and indeed the same one at different times, will succeed to different degrees, so that a slight variation in color, luminosity and saturation is inevitable.

Moreover, practically all the lithographic inks used in such work will fade, and fade surely and badly, a fatal objection to their use as standards. Another way to choose the working colors is to have in mind the pigment to be used in representing the color, as well as the particular wave-length desired.

It was the apparent advantages of the latter method, as well as the advice of good authorities, which led us to follow it in the choice of our working standards when we were asked to prepare the material in the 'Standard Dictionary.' In our choice we were influenced by the following considerations: Emerald green (Paris green) is of the desirable color, is very uniform and is easily obtained; similar advantages recommend artificial ultra-marine blue. For a red, evidently a vermilion should be taken, and in selecting 'English vermilion' we may have erred, but believe it the most uniform and best suited. Mineral orange seemed very nearly identical in different samples, and was adopted since its color was that desired. As to chrome yellow it may be very truly urged that there are great variations, but when the samples are chosen by wave-length, the character of the yellow is identical. The lack of a good, permanent violet pigment, as well as the apparent lack of the necessity of having a violet standard induced us to omit it. These pigments can be obtained everywhere, and for most purposes true enough to wave-length. They fade but slightly, if at all, and when mixed with thick gum arabic solution and applied like an oil paint to completely cover the surface their total luminosity and saturation is always practically the same. They thus furnish working standards which can be reproduced by anybody in any part of the world with great accuracy if necessary. Together with white cardboard and lamp black carried in shellac they enable an observer to produce practically any color, shade, hue or tint, by combining them as Maxwell disks.

Other pigments, other colors, may finally prove more worthy of general and final adoption, but it seems to us that the considerations which influenced us most seriously influence the final selection.

No doubt Mr. Pillsbury regretted that his system was not adopted for the 'Standard Dictionary', but that should not have induced him to insinuate that we copied his system, or to refer to a typographical error as 'an unintentional blunder.' We have no desire to belittle the work of Milton Bradley or Mr. Pillsbury, for they are doing much for the introduction of scientific methods into color study, but it did not seem best to us to attempt to define all colors, using only two colored discs at a time, and we do not believe that any lithographed surfaces should be adopted as ultimate standards, even though they may prove best adapted to educational purposes.

W. HALLOCK,
R. GORDON.

THE TERM 'INTERNAL SECRETIONS.'

TO THE EDITOR OF SCIENCE: At the beginning of his interesting paper on 'The Physiology of Internal Secretions,' SCIENCE, No. 132, Dr. Howell says: "We owe the term 'internal secretions' to Brown-Séquard, by whom it was first used in published communications dating from 1891." It may be worth while to note that Claude Bernard in his famous 'Rapport sur les progrès et la marche de la physiologie générale en France,' 1867, says, at page 73, "La cellule sécrétoire, au contraire, attire, crée et élabore en elle même le produit de sécrétion, qu'elle verse soit au dehors sur les surfaces muqueuses, soit directement dans la masse du sang. J'ai appelé *sécrétions externes* celles qui s'écoulent en dehors, et *sécrétions internes* celles qui sont versées dans le milieu organique intérieur."

C. B. DAVENPORT.

MUS. COMP. ZOOL., July 26, 1897.